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## False Positive Hoover's Sign in Apraxia

### Citation for published version:

Ercoli, T & Stone, J 2020, 'False Positive Hoover's Sign in Apraxia', *Movement Disorders Clinical Practice*.  
<https://doi.org/10.1002/mdc3.12970>

### Digital Object Identifier (DOI):

[10.1002/mdc3.12970](https://doi.org/10.1002/mdc3.12970)

### Link:

[Link to publication record in Edinburgh Research Explorer](#)

### Document Version:

Peer reviewed version

### Published In:

Movement Disorders Clinical Practice

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### **False positive Hoover's Sign in Apraxia**

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Word Count: 479

Running title: False positive Hoover's sign in apraxia

Keywords: Hoover's sign; Hip abductor sign; Functional Neurological Disorder; Corticobasal Syndrome; Psychogenic

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27   **For “*Clinical Vignette*” section of the Journal**

28

29   Hoover’s sign and hip abductor sign are positive diagnostic features of functional leg weakness in  
30   patients with functional neurological disorders (FND) (1). Hoover’s sign describes weakness of  
31   voluntary hip extension which returns to normal with contralateral hip flexion against resistance,  
32   whereas hip abductor sign is involuntary abduction of the weak leg while the contralateral leg is  
33   abducted against resistance (1). Although clinical studies, including our own (1), suggest high  
34   sensitivity and specificity, the nature of the sign predicts false positives in certain other neurological  
35   conditions.

36

37   The daughter of a 90-year old woman emailed one of the authors (JS) wondering if her mother’s  
38   undiagnosed condition was FND. The patient had a 5 year history of progressive inability to move  
39   her left arm and leg properly. Her daughter had noticed that she was able to walk better and use her  
40   arm in a more appropriate way when she was distracted. The patient told us that sometimes her left  
41   arm and leg did not respond to her control and “*they did funny things*”. Memory and concentration  
42   were preserved, mood was low but she was still maintaining her activities.

43   Neurological examination demonstrated hypomimia, marked left-sided rigidity affecting arm and  
44   leg, dystonia and severe apraxia (probably with limb-kinetic and ideomotor components), worse on  
45   the left side. (Video 1, Segment 1). Hoover’s and hip abductor signs were clearly positive (Video 1,  
46   Segments 2 and 3). Brain MRI showed posterior cortical atrophy, while SPECT-DaTscan was  
47   normal (Video 1, Segment 1).

48

49   We made a clinical diagnosis of Corticobasal Syndrome (CBS), with uncertain underlying  
50   pathology (2). As previously described, abnormal brain SPECT-DaTscan is not a mandatory feature  
51   of the disease (3).

52 Hoover's sign and the hip abductor sign indicate a discrepancy between voluntary movement and  
53 automatic movement. In apraxia, particularly in the ideomotor variant, similar "voluntary-automatic  
54 dissociation" is well described as an inability to execute a specific movement outside the natural  
55 context in which it occurs (4).

56 There may be shared brain pathways that explain why these clinical signs overlap. Several  
57 functional imaging studies in motor FND have found dysfunction of the temporoparietal junction,  
58 precuneus and other parietal areas as, suggesting abnormalities in the network responsible for an  
59 individual's 'agency' of movement. At another level, FND has been conceptualised as a distortion  
60 of 'top down' predictions and idea of limb function. Apraxia could be seen as a structural correlate  
61 of that phenomenon.

62 All clinical signs have their limitations. This case reinforces that any positive sign of FND should  
63 always be interpreted in the context of the whole clinical picture. In this case, the presence of  
64 apraxia was a clear alternative explanation for the positive Hoover's sign rendering the sign non-  
65 diagnostic. Dissociated emotional and voluntary facial movement in opercular syndrome,  
66 improvement when walking backwards or running in dystonia, aura of paroxysmal kinesigenic  
67 dyskinesia, and the ability to suppress movements in Tourette's syndrome are examples of similar  
68 diagnostic pitfalls (5).

69

## 70 **Acknowledgment**

71 We thank the patient and her daughter for their availability and cooperation.

72

## 73 **Author Roles**

74 1. Research project: A. Conception, B. Organization, C. Execution;

75 2. Statistical Analysis: A. Design, B. Execution, C. Review and Critique;

76 3. Manuscript Preparation: A. Writing of the first draft, B. Review and Critique.

77

78 TE: 1A, 1B, 1C, 3A

79 JS: 1A, 1B, 1C, 3B

80

## 81 **Disclosures**

82 **Ethical Compliance Statement:** The authors confirm that the approval of an institutional review  
83 board was not required for this work. The patient has given written and informed consent for online  
84 publication of her videos. We also confirm that we have read the Journal's position on issues  
85 involved in ethical publication and affirm that this work is consistent with those guidelines.

86 **Funding Sources and Conflicts of Interest:** The authors declare that there are no conflicts of  
87 interest relevant to this work.

88 **Financial Disclosures for the previous 12 months:** JS is supported by an NHS Scotland Career  
89 Research Fellowship (NHS Scotland). TE reports no sources of funding and no conflicts of interest.

90

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104    **Supporting information**

105    Supporting information may be found in the online version of this article.

106    **Video 1. Segment 1.** CBS clinical and radiological features. Left-sided upper limb apraxia and  
107    hand dystonia; left-sided stiffness; upper limb apraxia, worse on the left side; posterior cortical  
108    atrophy on brain MRI; and normal SPECT-DaTscan. **Segment 2.** Positive Hoover's sign. **Segment**  
109    **3.** Positive Hip abductor sign.